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PRE-APPEAL BRIEF REQUEST FOR REVIEW		Docket Number 119544-00101
I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to "Mail Stop AF, Commissioner for Patents, P. O. Box 1450, Alexandria, VA 22313-1450" [37 CFR 1.8(a)] on ______ Signature ______ Typed or printed name ______	Application Number 10/816,850	Filed April 5, 2004
	First Named Inventor Keller	
	Art Unit 1761	Examiner Sayala

Applicant requests review of the final rejection in the above-identified application. No amendments are being filed with this request.

This request is being filed with a notice of appeal.

The review is requested for the reason(s) stated on the attached sheet(s)
Note: No more than five (5) pages may be provided.

I am the

☐ Applicant/inventor

☐ Assignee of record of the entire interest
See 37 CFR 3.71. Statement under 37 CFR 3.73(b) is enclosed. (Form PTO/SB/96)

☒ Attorney or agent of record
Registration number 28,680

☐ Attorney or agent acting under 37 CFR 1.34
Registration number if acting under 37 CFR 1.34

MINH-QUAN K. PHAM
REG. NO. 50,594
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For Charles R. Wolfe, Jr.
Typed or printed name

202-772-5800
Telephone number

September 6, 2006
Date

Note: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below*.

☐ *Total of _____ forms are submitted.

119544.00101/35746495v.1

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:	
KELLER et al.	Examiner: C. D. Sayala
Serial No.: 10/816,850	Art Unit: 1761
Filed: April 5, 2004	Atty. Docket No.: 119544-00101
For: ENVIRONMENTALLY FRIENDLY GRANULATED POULTRY LITTER FERTILIZER	

PRE-APPEAL BRIEF REQUEST FOR REVIEW

Mail Stop AF
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In response to the Final Office Action mailed March 6, 2006, Applicant respectfully requests a pre-appeal brief review. A Notice of Appeal, a Petition for a three-month extension of time, and associated fees are submitted herewith. The review is requested for the reasons set forth below:

THE CLAIMS ARE NOT ANTICIPATED

Claims 1, 3, 5-9, 14, and 16-19 stand rejected under 35 U.S.C. § 102(b) as being anticipated by EP 474992 (EP '992). Claims 1, 3, 8-9, and 14 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Ethington, Jr. et al. (U.S. Patent No. 6,726,941). Claims 1-2, 8-13, and 19 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Connell (U.S. Patent

No. 6,461,399). Applicant respectfully traverses the rejections for the reasons set forth in the Amendment filed December 23, 2005.

None of the cited references teaches a fertilizer containing about 1-2.5% nitrogen and 0.35% phosphorus. This ratio is critical for the present invention because Applicant has discovered a method to inexpensively, effectively, and significantly lower the phosphorus content of poultry litter, while, at the same time, maintaining the high nitrogen content in the final fertilizer product.

In the Final Office Action, the Examiner alleges that the "nitrogen content and phosphrus content would have been inherent, because raw poultry shows such amounts to present. To show the raw poultry content, the Examiner points to Table 1 of the Specification and a Table entitled Nutrient Content of Fertilizer Materials. The Examiner's reasoning is erroneous because nitrogen and phosphorus contents of raw poultry litter cannot be equated with the final fertilizer. product. The nitrogen content of raw poultry litter is in ammonia (hence the mal odor of the raw poultry litter), which will evaporate during processing of the fertilizer. As such, the nitrogen content of raw poultry cannot be the same as that of the final product after much processing.

Further, Applicant attaches herewith two references, The Value and Use of Poultry Waste as Fertilizer by Charles C. Mitchell, Jr. ("Mitchell reference") and Manure as Fertilizer by Pete Christensen and Bill Peacock ("Christensen reference"), showing that the nutrient contents of manure products depend of how the raw manure is processed. The Mitchell reference specifically states:

> The chemical analysis of either type of manure is highly variable due to several factors. These include moisture, temperature, amount and kind of litter, amount of soil picked up in cleaning a house, the number of batches of broilers fed on the litter, and the conditions under which the manure was stored and <u>handled</u> before spreading.

Michell reference, 8th paragraph (emphasis added). Likewise, the second paragraph states:

> Actual nutrient content of manures varies depending on source, …, moisture content, storage, and <u>handling methods</u>.

Christensen reference, 2nd paragraph (emphasis added). Therefore, the Examiner's allegation that the nitrogen and phosphorus contents of raw poultry litter are the same as the final processed product is erroneous and without support.

THE CLAIMS ARE NOT OBVIOUS

Claims 1-3, 5-7, 14, and 16-18 stand rejected under 35 U.S.C. §103(a) as being obvious over Kazemdeh (U.S. Patent No. 5,772,721). Claims 3, 5-7, 14, and 16-18 stand rejected under 35 U.S.C. §103(a) as being obvious over Connell in view of Staples (U.S. Patent No. 5,730,772, and further in view of Cook (U.S. Patent No. 2,597,457), Doughty (U.S. Patent No. 462,476) and Thomas et al. (U.S. Patent No. 4,405,354). Applicant respectfully traverses the rejection for the reasons set forth in the Amendment filed December 23, 2005.

Kazemdeh fails to disclose that the fertilizer contains about 1-2.5% nitrogen and 0.35% phosphorus. The Examiner alleges that "it would have been obvious to one of ordinary skill in the art to follow the teachings of this reference and combine the lignosulfonate binder, the lime stone, and poultry waste," but fails to provide any motivation for modifying Kazemdeh to arrive at the present invention. According to MPEP 2142, "the initial burden is on the examiner to provide some suggestion of the desirability of doing what the inventor has done." Further, "it is the duty of the examiner to explain why the combination of the teaching is proper … A statement of a rejection … must explain with reasonable specificity at least one rejection, otherwise, the examiner procedurally fails to establish a *prima facie* case of obviousness." MPEP

2142. Here, because Examiner has ignored her burden prescribed by law and has failed to provide any suggestion or motivation to arrive at the present invention, she has not met her burden to establish a *prima facie* case of obviousness.

In addition, Applicant presented evidence of non-obviousness in the Amendment filed December 23, 2005, but this evidence has not been responded to by the Examiner in the Final Office Action.

With regard to the rejection over Connell in view of Staples, and further in view of Cook, Doughty, and Thomas et al., the references, taken alone or in combination, fail to disclose that the fertilizer contains about 0.35% phosphorus. Nevertheless, the Examiner alleges "to optimize amounts of these additives so as to obtain a final phosphorus content of about 0.35% would have been well within the realm of ordinary skill" (see page 6 of the Final Office Action). The Examiner's reasoning is based on Connell's disclosure on column 4, line 66 to column 5, line 6; however, this reasoning is erroneous. According to Connell, soil deficiencies and crop nutrient needs can be determined. However, the current inventive fertilizer having 0.35% phosphorus is not based on soil deficiencies or crop nutrient needs, but on environmental considerations. If one is to assess only soil deficiencies and nutrient needs, it would be desirable to increase phosphorus content, as phosphorus improves plant growth, which is inapposite to the present invention.

Moreover, the 0.35% phosphorus is much lower than that of the raw poultry litter. On the other hand, Connell, like Kazemdeh, teaches augmenting the phosphorus content of the fertilizer (see Amendment filed December 23, 2005, pages 8-9), which clearly teaches away from the present invention.

In the Final Office Action, the Examiner alleges that the teaching of augmenting phosphorus content "is a mere recognition of something any practitioner who is working with

poultry litter would have done" (Final Office Action, page 7). This clearly contradicts the Examiner's allegation that it would have been obvious for one of ordinary skill in the art to lower the phosphorus content in the final product.

CONCLUSION

In view of the foregoing, Applicants believe the application is in condition for allowance. Prompt and favorable action is therefore respectfully solicited.

In the event that there are any questions relating to this filing or to the application in general, it would be appreciated if the examiner would telephone the undersigned attorney concerning such questions so that the prosecution of this application may be expedited.

Please charge any shortage or credit any overpayment of fees to BLANK ROME LLP, Deposit Account No. 23-2185 (119544-00101). In the event that a petition for an extension of time is required to be submitted herewith and in the event that a separate petition does not accompany this response, Applicants hereby petition under 37 C.F.R. 1.136(a) for an extension of time for as many months as are required to render this submission timely.

Any fees due are authorized above.

Respectfully submitted,

Date: September 6, 2006

By: MINH-QUAN K. PHAM

FOR Charles R. Wolfe, Jr. REG. NO. 50,594

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Tulare County

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Publ. # NG7-97

Manure as a Fertilizer

Pete Christensen, Ext. Viticulture Specialist and Bill Peacock, Tulare County Farm Advisor

Manure is an excellent fertilizer containing nitrogen, phosphorus, potassium and other nutrients. It also adds organic matter to the soil which may improve soil structure, aeration, soil moisture-holding capacity, and water infiltration.

To determine how much manure is needed, the nutrient content and the rate nitrogen is mineralized (becomes available for plant uptake) needs to be estimated. Actual nutrient content of manures varies depending on source, (the level of protein being fed is more important than even the type of animal - dairy, beef, horse, etc.) moisture content, storage, and handling methods. The following table gives general information of percent moisture, nitrogen (N), phosphorus (P), and potassium (K) content in various manures.

Nutrient Content

The table gives some reported values of nitrogen, phosphorus, and potassium in manures.

	% Moisture	Approximate composition lbs. per ton		% Phosphorus
		Nitrogen	Potassium	
Fresh manure with normal quantity of bedding or litter.				
Dairy	86	11	10	0.55
Hog	87	11	9	0.55
Horse	80	13	10	0.65
Sheep	68	15	8	1.00
Steer, feedlot	75	12	11	0.65
Hen	73	22	10	1.10
Turkey	74	26	10	1.30
Dried commercial products:				
Dairy	16	18	31	0.90

Hog	10	45	20	2.25
Horse	8	14	10	0.70
Sheep	9	27	41	1.35
Steer, feedlot	15	41	38	2.05
Poultry (droppings)	8	83	31	4.15
(with litter)	13	41	23	2.05

**Adapted from Western Fertilizer Handbook, 5th Edition and Fresno County grape pomace analysis survey, 1965 and 1966.*

The nutrient content of manure listed in the table should be used as a general guideline when determining rates of application, keeping in mind the wide variability that exists among samples. Also, application rates must take into account mineralization or the rate of release of N as the manure decomposes (see decay series).

Common reasons for the variability of the nitrogen content in manure include type of animal and feed ration, amount of litter, bedding or soil included, and amount of urine concentrated with the manure.

Water content is another major reason for nutrient content variations and should always be considered when buying manure on a per-ton basis. Fresh manures generally contain 70% to 85% water. Air-dried manures will always retain some moisture -- typically around 10% to 15%. As manure dries, the nutrients not only concentrate on a weight basis, but also on a volume basis due to structural changes (settling) of the manure. Volatilization of urine nitrogen can result in considerable loss of nitrogen, up to 50% or more of the total nitrogen.

Generally, dry manure contains 2 to 3 cubic yards per ton; 2.5 cubic yards per ton is a typical figure used for dry poultry and steer manures but must be adjusted with higher moisture contents.

Handling Manure

Handling can greatly alter the value of manure, particularly its nitrogen content. Nitrogen is present in manure in a variety of forms, most of which gradually converts to ammonium and nitrate nitrogen.

The ammonium form can be lost to the air and the nitrates leached by rainfall. Ammonium losses can be minimized by not stockpiling manure while it is moist, minimizing its handling, and discing it under immediately after spreading. Such effects are demonstrated in the following chart.

Manure source	History	Nutrient composition	
		Nitrogen %	Potassium %
Droppings	Prompt drying	4.2	2.5
Center of moist stockpile	Enzyme hydrolysis and volatilization of ammonia	2.1	2.5
Outside of stockpile	Leaching by rain, enzyme hydrolysis, and volatilization of ammonia	1.8	1.6

**From Rackman et al. (1965)*

Some ammonia can be lost to the air each time manure is moved or hauled. Much of the loss is from hydrolysis of the NH_2 groups (enzymatic) and then volatilization of N_20 and NH_3. This loss can be very high when spreading manure, especially during warm, dry weather. Here, at least 50% of the ammonium nitrogen can be lost within 12 hours. Studies have also shown that, by one week after spreading, almost 100% of the ammonium nitrogen can be lost. This loss can represent up to 50% of the total nitrogen available in stockpiled manure.

Thus, the importance if discing in manure **immediately** after spreading is obvious.

Nutrient Availability and Manure Application

Manure is a source of many nutrients including: nitrogen, phosphorus, potassium and man others. However, nitrogen is often the main nutrient of concern for most crops.

Potassium deficiency is usually quite localized within a field and would not be corrected with common rates of manure. However, some improvement might be expected with high rates above 10 tons per acre. The high rates needed to correct a potassium (K) deficiency would supply an excess amount of nitrogen for many crops, and this should be avoided.

Rates of Manure for Nitrogen Needs

The nitrogen compounds in manure are eventually converted to the available nitrate form. Nitrate is soluble and is moved into the root zone with water. It is the same form ultimately available to plants from commercial nitrogen fertilizers.

However, the release of available nitrogen from the complete organic compounds during manure decomposition is very gradual. This slow release of nitrogen is manure's most important asset. It extends nitrogen availability and reduces leaching -- of particular importance in sandy soils.

"Decay series" of nitrogen availability

The nitrogen carry-over from previous years of manuring should always be taken into account in fertilizer programs. This can be done by using a "decay series". This is an estimate of the annual release of nitrogen from manure.

The idea is to first apply enough manure to meet the first year's need of available nitrogen. Decreasing amounts are then applied in following years because of the carry-over organic nitrogen that will be released from previous applications.

If the same rate of manure is applied each year, it is possible for a field originally low in nitrogen to accumulate unnecessarily high levels in successive years.

The calculations of this "decay series" can be complicated and change with year to year variations of soil microbial activity in the field. However, it provides a general idea how to adjust for carry-over nitrogen in manuring.

The nitrogen in poultry manure is in released fastest, as most is the urea or uric acid form, with 90% of nitrogen released in the first year.

Fresh manure which contains both the urine and solid portions and has a large amount of urea or uric acid provides a somewhat slower release rate, with approximately 75% of the total nitrogen released the first year.

An even more gradual nitrogen release can be expected from dry feedlot steer manure, with only 35% of the total nitrogen released the first year.

The following example gives the rates of three manure sources needed to maintain the equivalent rate of 50 lbs nitrogen per acre annually up to 5 years. This is adapted from a "decay series" published by Pratt el al. (1973).

"Decay Series"

Manure Source	Nitrogen Content %	% of Nitrogen released in 1st year	Tons manure/acre required to release 50 lbs of Nitrogen each year Time, years				
			1	2	3	4	5
Chicken (dry)	3.0	90	1.0	0.9	0.9	0.9	0.9
Dairy (fresh)	0.7	75	4.8	4.5	4.4	4.3	4.3
Feedlot, steer (dry)	1.5	35	4.8	3.4	3.0	3.0	2.9

Based on "decay series" of ***chicken*** *--.90, .10, .05;* ***dairy*** *-- .75, .15, .10, .05; and* ***feedlot*** *-- .35, .15, .10. 05.*

These figures demonstrate the need to adjust rates with time among the various manure sources, especially feedlot manure with its more gradual nitrogen release.

Other Benefits of Manure

The use of manure helps to maintain the organic matter content of the soil which may improve soil structure and water infiltration. However, manure is quickly decomposed under warm, moist soil conditions. With the manure rates used for most crops, organic matter content in soil is only temporarily increased.

Possible Disadvantages

Weeds... Weed seeds are common in some manures. They may enter the animal with its feed and then pass through the digestive tract, still viable, or they may have come with the litter, or they may have simply blown into the feed yard.

Poultry droppings typically have fewer weed seeds surviving the digestive processes. However, other animal manures may contain numerous viable weed seeds if the original feeds were contaminated. Compositing and stockpiling manures can reduce the number of viable weed seeds.

Salts... Manures commonly contain 4 to 5% soluble salts (dry weight basis) and may run as high as 10%. To illustrate, an application of 5 tons of manure containing 5% salt would add 500 lbs of salt.

Normally, irrigation and rain water will sufficiently leach well-drained soils to prevent damaging salt accumulations. However, one should be cautious with poorly drained soils, soils with existing salinity problems, or unusually high application rates, especially when concentrated near young plants.

Induced zinc deficiency... Zinc deficiency can be induced or increased with repeated high rates of manure, especially on sandy soils.

Moderate or infrequent applications do not normally present a zinc problem. However, growers should be aware of the potential problem, especially with soils and varieties or crops of known susceptibility to zinc deficiency.

Summary

The principal value of manure is its extended availability of nitrogen -- of particular value in the more readily leached sandy soils. Manure is also helpful in improving soil fertility in cut areas from land leveling.

Nutrient content and rate of availabilty varies widely, depending mostly on manure source, handling methods, and water content. Fresh manure which includes both liquid and solid fractions with the least handling and then disced in

immediately after spreading will retain the most nitrogen. A laboratory analysis of the manure for nitrogen content is useful. Be sure to take an accurate sample of the manure (requires a composite of many samples throughout the pile or lagoon).

Generally, poultry manure is highest in nitrogen content, followed by hog, steer, sheep, dairy, and horse manure. Feedlot, steer manure requires fairly high rates to meet first-year nitrogen requirements because of its lower nitrogen percent and gradual nitrogen release characteristics.

However, this feature provides for more continued nitrogen availability in succeeding years, allowing for progressively lower annual application rates to meet plant requirements.

Faster nitrogen-release sources, such as poultry manure, require more constant and lower annual rates to maintain nitrogen availability.

The possible advantages of organic matter content and disadvantages of weed seed and salt content should be considered in using manure.

References

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University of California Cooperative Extension - Tulare County
Send comments to: UCCE Tulare County Webmaster
Revised: January 28, 1998

THE VALUE AND USE OF POULTRY WASTE AS FERTILIZER.

Agriculture & Natural Resources Agronomy
Alabama Cooperative Extension Service, Auburn University, Alabama 36849-5612

Charles C. Mitchell, Jr., Extension Agronomist
James O. Donald, Extension Agricultural Engineer
John Martin, Consulting Agronomist

The Alabama poultry industry (broilers and layers) produces more than 735 million birds a year. These birds produce about 1.7 million tons of manure and litter.

The nutrients in this manure could adequately fertilize every acre of corn, cotton, wheat, and sorghum produced in Alabama or 800,000 acres of bermuda or fescue pasture.* In fact, the nitrogen (N), phosphate (p2o5), and potash (K2o) in poultry manure represent about 40 percent of the N, 90 percent of the P2O5, and 40 percent of the K2O spread each year in commercial fertilizers in Alabama.

Poultry manure, if properly handled, is the most valuable of all manures produced by livestock. It has historically been used as a source of plant nutrient and soil amendment. However, in areas of intense poultry production, excess manure represents a waste problem for producers.

In some areas, over-fertilizing pastureland with poultry manure has resulted in groundwater and surface water problems. These problems developed as excess nutrients washed off the land or leached into groundwater supplies.

To obtain the maximum economic value of the plant nutrients in poultry manure and to protect the water supply from excessive nutrient run-off or leaching, apply poultry manure to match the nutrient needs of the crop.

Nutrient Analysis
Two basic types of poultry wastes are produced in Alabama-broiler litter and caged layer manure (Table 1). Broiler litter, for fertilizing purposes, includes all floor-type birds such as broilers, pullets, and floor layers. Some type of bedding or litter material is used on the floor of these houses.

Caged layer manure is free from litter material and generally has a higher moisture content than manure from broiler houses. Both types of waste will contain feathers and some wasted food.

The chemical analysis of either type of manure is highly variable due to several factors. These include

Table 1. Estimation of Poultry Manure Production.

Type Of Poultry	Percent Moisture	Grow-Out Time Interval	Tons Produced Per 1,000 Birds
Broilers	20	6 to 7 weeks	2
Caged Layers	75	1 year	35 to 44

* Based on six grow-out cycles per year on pine shavings or peanut hull bedding.

moisture, temperature, amount and kind of litter, amount of soil picked up in cleaning a house, the number of batches of broilers fed on the litter, and the conditions under which the manure was stored and handled before spreading.

Table 2 shows both the average and range of nutrient composition of broiler litter sampled in Alabama from 1977 through 1987. During this 11-year period, the litter from 147 broiler houses had an average moisture content of 19.7 percent and an average fertilizer content on a dry-weight basis of 3.9 percent N, 3.7 percent P2O5, and 2.5 percent K2O.

Table 2. Nutrient Composition Of Litter (Dry-Weight Basis) From 147 Broiler Houses Sampled In Alabama, 1977-1987.

	Average Analysis (percent)	Range (percent)
Moisture	19.7	15.0 to 39.0
Nitrogen (N)	3.9	2.1 to 6.0
Phosphate (P2O5)	3.7	1.4 to 8.9
Potash (K2O)	2.5	0.8 to 6.2
Calcium (Ca)	2.2	0.8 to 6.1
Magnesium (Mg)	0.5	0.2 to 2.1
Sulfur (S)	0.4	0.01 to 0.8

In 1981, litter from two slat-breeder houses and one pullet house and manure from two high-rise caged layer houses were analyzed for moisture and nitrogen. Results are given in Table 3.

The nitrogen content of litter from the pullet house was only about one-third the nitrogen content of broiler litter (Table 2). The nitrogen content of litter from the slatbreeder house was about half that of broiler litter.

Table 3. Nitrogen Content (Dry-Weight Basis) From HighRise Caged Layer, Pullet, And Slat-Breeder Houses In Cullman County Sampled In July 1981.

Type Of Poultry House	Moisture (percent)	Nitrogen (percent)
Caged Layer *	63.4	1.2**
Pullet	22.0	1.2
Slat Breeder*	16.8	2.1

* An average of two houses.
** The caged layer manure had been accumulating for about 12 months and had lost much of the ammonium nitrogen.

Caged layer manure generally contains about 4 to 7 percent nitrogen if collected at one to three week intervals. However, under high-rise houses where layer manure sometimes accumulates for long periods of time, much of the nitrogen is lost into the air as ammonia. The nitrogen content of the accumulated caged layer manure given in Table 3 was only 1.2 percent.

Moisture is perhaps the single most important variable associated with spreading manure by the ton. Manure from all classes of chickens will average 70 to 77 percent moisture when excreted. However, broiler manure with litter dries under normal house conditions and will average about 20 percent moisture. Caged layer manure will average about 70 percent moisture.

Analyses should be reported on both a dry-weight basis (oven dried) with little moisture and on a wet-weight basis just as the sample was taken. Reporting on a dry-weight basis eliminates the moisture

variable when comparing manures.

When spreading manures, the moisture adds weight and can reduce the value of the product in proportion to the moisture present (Table 4). Be sure the value you use when spreading manure by the tone is on a wet-weight basis or just as the manure sample was taken.

Table 4. Estimated Analysis And Value Of Poultry Manure On A Wet-Weight And Dry-Weight Basis (0-Percent Moisture).

Type	Percent Moisture*	Percent Nutrients (N-P2O5-K2O)	Pounds Per Ton (N-P2O5-K2O)	Value Per Ton**
Broiler	20	3.1-3.0-2.0	62-60-40	$33.25
Broiler	Oven-dry	3.9-3.7-2.5	78-74-50	$41.80
Caged layer	70	1.5-1.3-0.5	30-26-10	$14.20
Caged layer	Oven-dry	5.0-4.3-1.7	100-86-34	$47.30

*Use the higher moisture value when buying or spreading manures as it comes from the house.
** Calculations based on N at 25 cents per pound, P2O5 at 20 cents per pound, and K2O at 15 cents per pound.

Nutrient Availability

Poultry manure should be managed for its N value. However, N availability is the most difficult of the three major nutrients to predict. About 25 to 30 percent of the total N in broiler litter is in the urea and ammonium forms (Figure 1). It is readily available for plant uptake just as fertilizer ammonium and fertilizer urea.

When litter analyses are run by a laboratory, the readily available N is reported as ammonium N or NH4-N. Fertilizer urea and manure urea are likely to convert to ammonia gas (NH3) and then to evaporate.

When manure has a strong ammonia odor or is spread on the surface and not incorporated into the soil, significant nitrogen will be lost. As much as 75 percent of the ammonium N (22 percent of total N) could be lost within seven days after spreading if the weather is hot and dry and the manure is not soil-incorporated.

Of course, incorporation is not practical or even desirable in situations such as pastureland or hay fields, and ammonium N loss should be included in the total amount to be applied.

The organic N fraction gradually becomes available for crop uptake as the manure decomposes. Scientists in Virginia estimated that for broiler litter, about 50 percent of the organic N is released during the first year following application, 12 percent within the second, 5 percent during the third, and 2 percent during the fourth.

The percentages would be similar for North Alabama, but decomposition will be somewhat faster when manure is incorporated into the sandy soils of South Alabama. Therefore, the total amount of N available from manure applications is the sum of that available from applications being made at a given time plus that available from previous applications (residual N).

The P and K fractions are considered to be about 75 percent as effective as commercial fertilizers during the year of application. However, manure applications should be based on the N requirement of the crop because excess nitrogen can leach into groundwater or run off into streams, creating environmental concerns. If litter is applied at rates that will supply the N needed by the crop,

adequate P and K are generally available.

Under frequent manure applications, P will build up in Alabama soils to very high levels. Potash may leach in sandy soils and some fertilizer K applications may be necessary to meet the needs of certain crops, particularly hay crops.

Land Application
When applying poultry manure to cropland, pastureland, and hay fields, consider the following.

1) Determine the nutrients in the manure or litter prior to spreading. An analysis by a commercial laboratory would determine exactly how much moisture, ammonia N, organic N, and other plant nutrients are in the sample. This will allow you to calculate the value of the manure and how much to spread. If a chemical analysis is not made, a good estimate of the fertilizer content of litter is as follows: A ton of broiler litter with 20-percent moisture contains 60 pounds of nitrogen, 60 pounds of phosphate, and 40 pounds of potash. However, keep in mind that stored litter can change over time unless it is protected, and an analysis may take as long as two weeks.

2) Determine the nutrients needed by the crop to be grown. Soil testing provides the best estimate of residual P and K in the soil and other soil amendments (e.g., lime) that should be applied for optimum yields and nutrient use efficiency. Recommended N rates are given for each crop on the soil test report. Exceeding the recommended rates by more than 30 percent could result in excessive N leaching in some soils or the potential for surface run-off into streams.

3) Estimate the availability of N in the manure. The calculate a rate of application that is consistent with the requirements from the soil test report (see Circular ANR -244a, "Worksheet For Calculating Poultry Waste").

Other Recommendations
Reducing ammonium odors. To conserve N in poultry manure and to reduce the ammonia odor and associated N loss, apply superphosphate at the rate of 100 pounds per ton of manure in the house. The phosphate will trap the ammonia as ammonium phosphate, and it will increase the fertilizer value of the final litter. Fermentation losses in broiler litter may be reduced by using litter materials which rapidly dry the manure. The most effective means of reducing N losses is to dry the manure in the poultry house.

Adding hydrated lime. Hydrated lime (calcium hydroxide) will help maintain good litter condition and reduce fly problems. However, it will also increase ammonia volatilization and N loss. Do no use it when the ammonia level in the house is high. Use lime at the rate of 50 pounds per 1,000 square feet of floor space.

Outside storage problems. Manure stored outside and exposed to the weather will decompose rapidly. An ashy gray appearance indicates a loss of nutrient value. The N and organic matter will be greatly reduced and K may be lost due to leaching. You get maximum fertilizer value when manure or litter is protected from the weather.

N-use efficiency. Where excess quantities of manure must be disposed of on the land, choose a system to maximize N uptake by a crop. Row crops are poor users of soil N because of limited root systems. Corn or cotton may take up only 50 to 60 percent of the

N applied. Grasses, such as hybrid bermudagrasses, produce large amounts of dry matter and are efficient N users. As much as 90 percent of the applied N could be recovered by a good bermudagrass sod.

Cool-season grasses are not quite as efficient because most of their growth is in the early spring. The mineral N in manure applied in the summer and winter to cool-season crops such as tall fescue may be lost through leaching. Apply manure to crops to maximize N uptake and N-use efficiency. Harvest excess forage frequently to remove the N from the land. These practices will minimize potential surface and groundwater contamination from excess N applied in manure.

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